

Grain Inspection Hand Book

Montana Standards

Book 1 – Chapter 6

Hulless Barley

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BOOK 1, CHAPTER 6
HULLESS BARLEY

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6.1 GRADE AND GRADE REQUIREMENTS

Hulless barley is divided into three classes based on kernel characteristics and quality. Hulless Waxy Barley and Hulless Barley are divided into three numerical grades. Feed Hulless Barley is divided into three numerical grades and sample grade. Special grades are provided to emphasize special qualities or conditions affecting the value of the Hulless Barley. Special graded are added to and made a part of the grade designation. They do not affect the numerical or sample grade designation.

Table No. 1 – Hulless Waxy Barley

Grade	Minimum limits of -		Maximum limits of -			
	Hulless Waxy Barley Percent	Sound Hulless Waxy Percent	Foreign Material Percent	Heat Damage Percent	Damaged Kernels (Total) <u>1/</u> Percent	Non-Barley Material <u>2/</u> Percent
MT NO.1	98.0	97.0	0.5	0.2	2.0	1.0
MT NO.2	97.0	96.0	1.0	0.2	3.0	2.0
MT NO.3	97.0	95.0	2.0	0.5	5.0	3.0

1/ Includes Heat-damaged kernels.

2/ Includes Foreign Material, Other Grains and Dockage.

The following factors shall be recorded on all certificates regardless of grade:
 Adherent Hulls, Broken Kernels, Conventional Barley, Identify Damaged Kernels, Dockage, Moisture Sound Hulless Barley, Stones, Test Weight Per Bushel, Thin and Plump Hulless Barley, Wild Oats, Foreign Material, Non-barley material, Percent Hulless Barley and Variety.

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Table No. 2 – Hulless Barley

Grade	Minimum limits of -		Maximum limits of –			
	Hulless Waxy Barley	Sound Hulless Waxy	Foreign Material	Heat Damage	Damaged Kernels (Total) <u>1/</u>	Non-Barley Material <u>2/</u>
	Percent	Percent	Percent	Percent	Percent	Percent
MT NO.1	98.0	97.0	0.5	0.2	2.0	1.0
MT NO.2	97.0	96.0	1.0	0.2	3.0	2.0
MT NO.3	97.0	95.0	2.0	0.5	5.0	3.0

1/ Includes Heat-damaged kernels.

2/ Includes Foreign Material, Other Grains and Dockage.

The following factors shall be recorded on all certificates regardless of grade:
 Adherent Hulls, Broken Kernels, Conventional Barley, Identify Damaged Kernels, Dockage, Moisture Sound Hulless Barley, Stones, Test Weight Per Bushel, Thin and Plump Hulless Barley, Wild Oats, Foreign Material, Non-barley material, Percent Hulless Barley and Variety.

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Table No. 3 – Feed Hulless Barley

Grade	Minimum limits of -		Maximum limits of -			
	Test Weight Per Bushel Percent	Hulless Waxy or Hulless Percent	Foreign Material Percent	Heat Damage Percent	Heat Damage Percent	Damaged Kernels (Total) <u>1/</u> Percent
MT NO.1	48.0	95.0	95.0	2.0	2.0	5.0
MT NO. 2	46.0	90.0	90.0	5.0	5.0	10.0
MT NO. 3	43.0	80.0	80.0	10.0	10.0	20.0
<p>MT Sample Grade... MT Sample Grade shall be hulless barley which –</p> <p>Does not meet the requirements for MT.NO. 1, 2, or 3; or Contains 5 or more insect damaged kernels per 100 grams; or Contains 1 or more pieces of glass, 3 or more crotalaria seeds, 2 or more castor beans, 4 or more cocklebur or similar seeds singly or in combination; or Contains two or more rodent pellets, bird droppings, or an equivalent quantity of other animal filth, two or more particles of an unknown foreign substance, or a commonly recognized harmful or toxic substance(s) per 1-1/8 to 1-1/4 quarts of hulless barley; or</p> <p>A. Has a Musty, Sour, or commercially Objectionable Foreign Odor (Except Smut); or</p> <p>B. Heating or otherwise distinctly low quality.</p>						
<p><u>1/</u> Includes Heat Damaged Kernels. Sprouted kernels are not considered as Damage in Feed Hulless Barley and will not count against Sound or be included in Damaged Kernels (Total).</p> <p>The following factors shall be recorded on all certificates regardless of grade: Adherent Hulls, Broken Kernels, Conventional Barley, Identify Damaged Kernels, Dockage, Moisture, Sound Hulless Barley, Stones, Test Weight Per Bushel, Thin and Plump Hulless Barley, Wild Oats, Foreign Material, Non-barley material, Percent Hulless Barley and Variety.</p>						

6.2 –GRADE DESIGNATIONS

Use the following guidelines when signing grades on pan tickets and certificates.

- A. The abbreviation “MT”.
- B. The abbreviation “NO.” and the number of the grade or the words “Sample Grade”;
- C. The applicable special grade(s) in alphabetical order;
- D. The word “dockage” and the percentage thereof.

In addition, include the following on the pan ticket and in the “Results” section of the certificate.

- A. When applicable, the number of insect-damaged kernels.
- B. When applicable, the percentage of protein.
- C. Record the number of stones.

6.3 – PERCENTAGES

Determine percentages on a weight basis to a nearest tenth percent except for class, kind of grain, plump, and ergot. Report ergot to the nearest hundredth percent. The percentage when determining plump, the kind of grain and class in hulless barley is recorded to the nearest whole percent. Calculate percent by dividing the weight of the material removed by the weight of the portion used and multiplying by 100.

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Table No. 4 – How Factors Are Recorded

NEAREST WHOLE PERCENT	NEAREST TENTH PERCENT	NEAREST HUNDREDTH PERCENT	BY COUNT
Class Kind of Grain Plump Hulless Barley	Adherent Hulls Broken Kernels Conventional Barley Damaged Kernels (Total) Dockage Foreign Material Heat-Damaged Kernels Moisture Non-Barley Material Other Grain Sound Hulless Barley Test Weight per Bushel Thin Hulless Barley Wild Oats	Ergot	Animal Filth Castor Beans Cockleburrs Crotalaria Seeds Garlic Bulblets Glass Insects Large Debris Smut Stones Unknown Foreign Substance(s) or a Commonly Recognized Harmful or Toxic Substance(s)

6.4 – BASIS OF DETERMINATION

Distinctly Low Quality: The determination of distinctly low quality is made on the basis as a lot as a whole at the time of sampling when a condition exists that may or may not appear in the representative sample and/or the sample as a whole.

Certain Quality Determinations: Each determination of rodent pellets, bird droppings, other animal filth, broken glass, castor beans, cockleburrs, crotalaria seeds, dockage, live insect infestation, large stones, moisture, temperature, garlic and unknown foreign substance(s), and a commonly recognized harmful toxic substance(s) is made on the basis of the sample as a whole. When a condition exists that may not appear in the representative sample, the determination may be made on the basis of the lot as a whole at the time of sampling.

All Other Determinations: Other determinations not specifically provided for under the general provisions are made on the basis of grain when free from dockage, except the determination for odor is made on either the basis of grain as a whole or the grain when free from dockage.

Table No. 5 – Basis of Determination

FACTORS DETERMINED <u>BEFORE</u> THE REMOVAL OF DOCKAGE	FACTORS DETERMINED <u>AFTER</u> THE REMOVAL OF DOCKAGE
Animal Filth Castor Beans Cockleburrs Crotalaria Seeds Garlic Bulblets Glass Heating Infested Kind of Grain Large Debris Moisture Odor Other Unusual Conditions Unknown Foreign Substance(s) or a Commonly Recognized Harmful or Toxic Substance(s)	Adherent Hulls Broken Kernels Class Damaged Kernels (Total) Ergot Foreign Material Heat-Damaged Kernels Odor Other Grains Plump Hulless Barley Sound Hulless Barley Smut Stones Test Weight Per Bushel Thin Hulless Barley Wild Oats

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A general procedure based on the “basis of determination” definition is followed in the inspection and grading of hulless barley. However, the procedure may vary according to the test required to determine the grade. The following sections of this chapter are arranged in a logical sequence typically followed in the inspection and grading of hulless barley.

6.5 – DEFINITION OF HULLESS BARLEY

Grain which, before the removal of dockage consists of 80 percent or more of hulless or conventional barley and not more than 20 percent of other grains for which standards have been established under the United States Grain Standards Act or Montana standards. The term “hulless barley” as used in these standards shall include all types and varieties of hulless barley.

If the sample does not meet the definition of hulless barley, examine it further to determine if it is:

- a. Another commodity for which standards have been established or
- b. Not standardized commodity and factor results will be given.

6.6 – CLASSES

Hulless barley is divided into three classes:

1. Hulless Waxy Barley: Hulless waxy barley of the waxy barley types which contains not more than 3.0 percent of hulless barley or conventional barley, either single or combined.
2. Hulless Barley: Hulless barley of the hulless barley types which contains no more than 3.0 percent of hulless waxy barley or conventional barley, either singly or combined.
3. Feed Hulless Barley: Hulless waxy barley or hulless barley which does not meet the grade requirements of Montana Number 1, 2, or 3 of hulless waxy barley or hulless barley.

6.7 – HEATING

Hulless Barley developing a high temperature from excessive respiration is considered heating. Heating hulless barley, in its final stages, will usually have a sour or musty odor. Care should be taken not to confuse hulless barley that is heating with hulless barley that is warm and moist because of storage in bins, railcars, or other containers during hot weather.

Basis of Determination: Determine heating on evidence obtained at the time of sampling.

Certification: Grade heating hulless barley MT Sample Grade and record the work “Heating” on the pan ticket and in the “Results” section of the certificate.

6.8 – ODOR

Basis of Determination: Determine odor on evidence obtained at the time of sampling and on the sample either before or after the removal of dockage.

Table No. 6 – Odor Classification Examples

SOUR	MUSTY	COMMERCIALY OBJECTIONABLE FOREIGN ODORS
Boot Fermenting Insect (acid) Pigpen Smoke <u>a/</u>	Ground Insect Moldy	Animal hides Decaying animal & vegetable matter Fertilizer Fumigant Insecticide Oil products Skunk Smoke (evidence of fire-burnt material) Strong weed
a/ Consider smoke odors as sour unless there is evidence of fire-burnt material.		

Musty or Sour Odors: High temperatures resulting from excessive respiration cause hulless barley to heat and give off a Musty or Sour odor.

Musty or sour odor in hulless barley includes musty, sour, earthy, moldy, ground odor; or a rancid, sharp, and acrid insect odor. An acrid insect odor (usually referred as “lesser grain borer” odor) is considered sour. An insect odor other than acrid (usually referred to as “bran bugs” odor) is considered musty.

Commercially Objectionable Foreign Odor: Commercially objectionable foreign odor is odors, except smut, that are foreign to grain and render it unfit for normal commercial usage.

Fumigant or insecticide odors are considered commercially objectionable foreign odors if they linger and do not dissipate. When a sample of hulless barley contains fumigant or insecticide odor that prevents a determination as to whether any other odor(s) exists, apply the following guidelines:

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- A. Allow the sample to aerate in an open metal container not to exceed four (4) hours; and
- B. If the fumigant odor persists after four (4) hours, consider the sample as having a commercially objectionable foreign odor and grade it accordingly.

Certification: Grade hulless barley containing a musty, sour or commercially objectionable foreign odor as MT Sample Grade. Record the words “Musty”, “Sour”, or “Commercially Objectionable Foreign Odor” on the pan ticket and on the certificate.

6.9 – MOISTURE

Water content in grain as determined by an approved device.

Basis of Determination: Determine moisture by UGMA Moisture Machine or any other method which gives equivalent results. Moisture determination shall be made on a representative portion of the original sample before the removal of dockage.

Certification: Record the percentage of moisture on the pan ticket and the certificate to the nearest tenth percent.

6.10 – DISTINCTLY LOW QUALITY

Consider hulless barley distinctly low quality when it is obviously of inferior quality and the existing grade factors or guidelines do not properly reflect the inferior condition.

Basis of Determination: Use all available information to determine whether the hulless barley is of distinctly low quality. Determine distinctly low quality on the lot as a whole or the sample as a whole.

Large Debris: Hulless barley containing two or more stones, pieces of glass, pieces of concrete, or other pieces of wreckage or debris which are visible to the sampler and too large to enter the sampling devise is considered distinctly low quality.

Other Unusual Conditions: Hulless barley that is obviously affected by other unusual conditions (including diatomaceous earth) which adversely affects the quality of the hulless barley and cannot be properly graded by use of the grading factors specified or defined in the standards is considered distinctly low quality.

Certification: Grade distinctly low quality hulless barley as MT Sample Grade. Record the word “Distinctly Low Quality” and the reason(s) why on the pan ticket, the factor “Distinctly Low Quality” in the “Results” section on the certificate and the reason(s) in the “Remarks” section of the certificate.

6.11 – DOCKAGE

All matter other than hulless and conventional barley that can be removed from the original sample by use of an approved device. Also, under developed, shriveled and small pieces of hulless and conventional barley kernels removed in properly separating the material other than hulless and conventional barley that cannot be recovered by properly rescreening or recleaning.

Basis of Determination: Determine dockage on a portion of approximately 1-1/8 to 1-1/4 quarts.

Determining Dockage with the Carter Dockage Tester: Set up the Carter dockage tester as follows:

- A. Set the air control at Number 4.
- B. Set the feed control at Number 6.
- C. Use a Number 6 riddle in the riddle carriage.
- D. Use a Number 8 sieve in the top sieve carriage.
- E. Use a number 6 sieve in the middle sieve carriage.
- F. Use no sieve in the bottom sieve carriage.

If the material that passed over the Number 6 sieve (middle collection pan) contains more than 0.1 percent mustard seed, wild buckwheat, or similar size seed, rescreen with a hand sieve as follows:

- A. Use a 5/64-inch equilateral triangular hole sieve and bottom pan.
- B. Place the material that passed over the Number 6 sieve on the upper edge of the 5/64-inch sieve.
- C. Hold the sieve at a 10- to 20-degree angle and work the material down over the sieve with a gentle side-to-side motion.
- D. Hulless, conventional barley and other material remaining on top of the sieve shall be returned to the cleaned hulless and conventional barley that passed over the Number 8 sieve (top collection pan).
- E. All material that passed through the 5/64-inch hand sieve shall be considered dockage.

Dockage will then consist of:

- A. The material removed by the aspirator (air collection pan).
- B. The coarse material, other than hulless barley and conventional barley, that passed over the riddle (riddle collection pan).
- C. The material that passed through the Number 6 sieve (bottom collection pan).
- D. The material that passed through the 5/64-inch hand sieve.

To avoid repeating operations, check the dockage for live weevils and other insects injurious to stored grain and sample grade factors. Live weevils and other live insects injurious to stored grain and sample grade factors are considered dockage but, when present in excessive quantities, are also considered in the determination of the special grades “Infested,” and “MT Sample Grade” as the case may be.

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Certification: Record the percentage of dockage on the pan ticket and the certificate to the nearest tenth percent.

6.12 – TEST WEIGHT PER BUSHEL

The weight per Winchester bushel (2, 150. 42 cubic inches) as determined using an approved device.

Basis of Determination: Determine test weight per bushel on a dockage-free portion ranging in size from 1-1/8 to 1-1/4 quarts.

Certification: Record test weight per bushel on the pan ticket and the certificate to the nearest tenth percent.

6.13 – MONTANA SAMPLE GRADE

Basis of Determination: Determine MT Sample Grade factors, before the removal of dockage on the lot as a whole and/or a portion of approximately 1,000 to 1,050 grams. When a condition exists that may not appear in the sample, the determination may be made at the time of sampling. Table No. 7 shows the factors and corresponding line slides, tolerances and the appropriate basis of determination.

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Table No. 7 – MT. Sample Grade Factors

FACTOR	LINE SLIDE	NUMBER/WEIGHT LIMITS	BASIS
Any Grading Factor		Excess of Limit for MT NO. 3	Sample
Animal Filth	OF-Animal Filth	2 or more	Lot/Sample
Castor Beans	OF-Castor Beans	2 or more	Lot/Sample
Cockleburs	OF- Cocklebur, Yellow Star Thistle, etc. Lot/Sample		4 or more
Crotalaria Seeds <u>2</u> /	OF-Crotalaria & Lot/Sample	Velvet Leaf Seeds	3 or more
Diatomaceous Earth*		Presence	Lot/Sample
Glass		1 or more	Lot/Sample
Heating		Presence	Lot
Insect-Damaged		See Section 1.26	Lot/Sample
Large Debris*		2 or more	Lot/Sample
Odor		Presence	Lot/Sample
Other Unusual Conditions*		Presence	Lot/Sample
Unknown Foreign substance(s) or a	OF-31.0	2 or more	Lot/Sample

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Certification: Grade hulless barley MT Sample Grade when one or more of the limits in Table 7.0 are exceeded. Record the reason(s) why on the pan ticket and in the “Results” section of the certificate.

6.14 – SPECIAL GRADES AND SPECIAL GRADE DESIGNATIONS

Special grades draw attention to unusual conditions in the grain and are made part of the grade designation.

The definitions and examples of the designations for special grades in hulless barley are:

- A. Ergoty Hulless Barley: Hulless barley that contains more than 0.05 percent ergot.

Example: MT. NO. 3 Hulless Waxy Barley, Ergoty, Dockage 1.2%

Ergot is a hard, reddish-brown or black grain-like mass of certain parasitic fungi that replaces the kernels of hulless barley.

Basis of Determination: Determine ergoty on a dockage-free portion of approximately 250 grams. Ergot also functions as foreign material.

Certification: When applicable, record the word “Ergoty” on the pan ticket and the certificate in accordance with Section 1.2, Grade Designations. Record the percentage of ergot to the nearest hundredth percent on the pan ticket and in the “Results” section of the certificate.

- B. Garlicky Hulless Barley: Hulless barley that contains in a 1,000 gram portion more than two green garlic bulblets or an equivalent quantity of dry or partially dry bulblets.

Example: MT. NO. 2 Hulless Waxy Barley, Garlicky, Dockage 0.7%

Basis of Determination: Determine garlicky before the removal of dockage on a portion of approximately 1,000 grams except in those cases where the garlic bulblet count is in excess of ten green bulblets. When garlic bulblets are in excess of ten green bulblets on the 250 gram portion, multiply the count by four to obtain the equivalent number of bulblets in 1,000 grams.

Characteristics of Bulblets:

- a. Green garlic bulblets are bulblets which have retained all of their husks intact.
- b. Dry or partly dry garlic bulblets are bulblets which have lost all or part of their husks. Consider bulblets with cracked husks as dry.
- c. Three dry or partly dry garlic bulblets are equal to one green bulblet. Garlic bulblets apply in the determination of garlicky but also function as dockage or foreign material as the case may be. (Reference: Interpretive Line Side No’s OF-13.0 and OF-13.1).

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Certification: When applicable, record the word “Garlicky” on the pan ticket and the certificate in accordance the Section 1.2, Grade Designations. Record the number of garlic bulblets in whole and thirds on the pan ticket and the “Results” section of the certificate.

- C. Infested Hulless Barley. Hulless barley that is infested with live weevils or other live insects injurious to stored grain.

Example: MT. No. 1 Hulless Barley, Infested, Dockage 0.0%

The presence of any live weevil or other live insects injurious to stored grain found in the work sample indicates the probability of infestation and indicates that the hulless barley must be carefully examined to determine if it is infested. In such cases, examine the work sample and the file sample before reaching a conclusion as to whether or not the hulless barley is infested. Do not examine the file sample if the work portion is insect free.

Live weevils shall include rice weevils, granary weevils, maize weevils, cowpea weevils and lesser grain borers. Other live insects injurious to stored grain shall include grain beetles, grain moths, vetch bruchids, and larvae.

Basis of Determination: Examine for insects before the removal of dockage.

For specific guidelines, see tables 8 and 9.

Certification: When applicable, record the word “Infested” on the pan ticket and certificate in accordance with Section 1.2, Grade Designation.

Table No. 8 - Insect Infestation Guide

SAMPLE DESIGNATION	INFESTED LEVEL 1/
<p>REPRESENTATIVE SAMPLE – Applies to submitted sample, lots probe-sample, and D/T-sampled railcars/trucks. Examine work portion and file sample. (Do not examine file sample if work portion is insect free.)</p> <p>LOT AS A WHOLE (STATIONARY) – Applies at the time of sampling for lots probe-sampled.</p> <p>LOT AS A WHOLE (CONTINUOUS LOADING – <u>2/</u>) Applies to: - each railcar when inspected under Cu-Sum. - each subsample for sacked grain lots. - each component sample for bargelots and shiplots. <u>3/</u></p>	<p>2 lw* or 1 lw + 1 oli* or 2 oli*</p> <p>Same</p> <p>Same</p>
<p>* lw = live weevil, oli= other live insects injurious to stored grain.</p>	
<p><u>1/</u> Samples containing infestation at these levels are infested. <u>2/</u> Minimum sampling rate for online operations is 500 grams per 2,000 bushels. <u>3/</u> Minimum component size is approximately 10,000 bushels.</p>	

- D. Light Smutty Hulless Barley. Hulless barley that has an unmistakable odor of smut, or which contains in a 250-gram portion smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 2 smut balls, but not in excess of a quantity equal to 15 smut balls of average size.

Example: MT. NO. 3 Hulless Waxy Barley, Light Smutty, Dockage 1.7%

Smut is a plant disease characterized by the appearance of smut balls or smut spores.

- E. Smutty Hulless Barley. Hulless barley that contains, in a 250-gram portion, smut balls, portions of smut balls, or spores of smut in excess of a quantity equal to 15 smut balls of average size.

Example: MT. NO. 2 Hulless Barley, Smutty, Dockage 0.2%

Basis of Determination: Determine “Light Smutty” on the sample as a whole “Odor Only” or on a dockage-free portion of approximately 250 grams. Determine “Smutty” on a dockage-free portion of approximately 250 grams. Smut balls apply in the determination of the special grades “Light Smutty” or “Smutty” but also function as foreign material.

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Certification: When applicable record the words “Light Smutty” on the pan ticket and the certificate in accordance with Section 1.2, Grade Designation. Record the number of smut balls on the pan ticket and in the “Results” section of the certificate.

6.15 – BADLY STAINED or MATERIALLY WEATHERED HULLESS BARLEY

Hulless barley that is badly weather stained or materially weathered.

Basis of Determination: Determine the appearance factors “Badly Weather Stained” or “Materially Weathered” on a dockage-free portion of 1-1/8 or 1-1/4 quarts. Grade badly stained or materially weathered hulless barley no higher than MT. NO. 3.

Badly Weather Stained or Materially Weathered Hulless Barley: Hulless Barley that is badly weather stained or materially weathered shall be graded not higher than U.S. No. 3.

Basis of Determination: Determine general appearance on the sample as a whole.

Badly Weather Stained: When kernel discoloration due to weather has progressed to a point where many of the kernels are badly discolored and weathered, the safflower seeds are badly weather stained.

Certification: Record the words “Badly Weather Stained” or “Materially Weathered” on the pan ticket and in the “Results” section of the certificate.

6.16 – STONES

Stones shall be concreted, earthy, or mineral matter and other substances of similar hardness which will not disintegrate readily in water.

Basis of Determination: Determine stones on a dockage-free portion of 1-1/8 or 1-1/4 quarts.

Certification: Record the number of stones on the pan ticket and the certificate.

6.17 – PROCESSING THE WORK SAMPLE

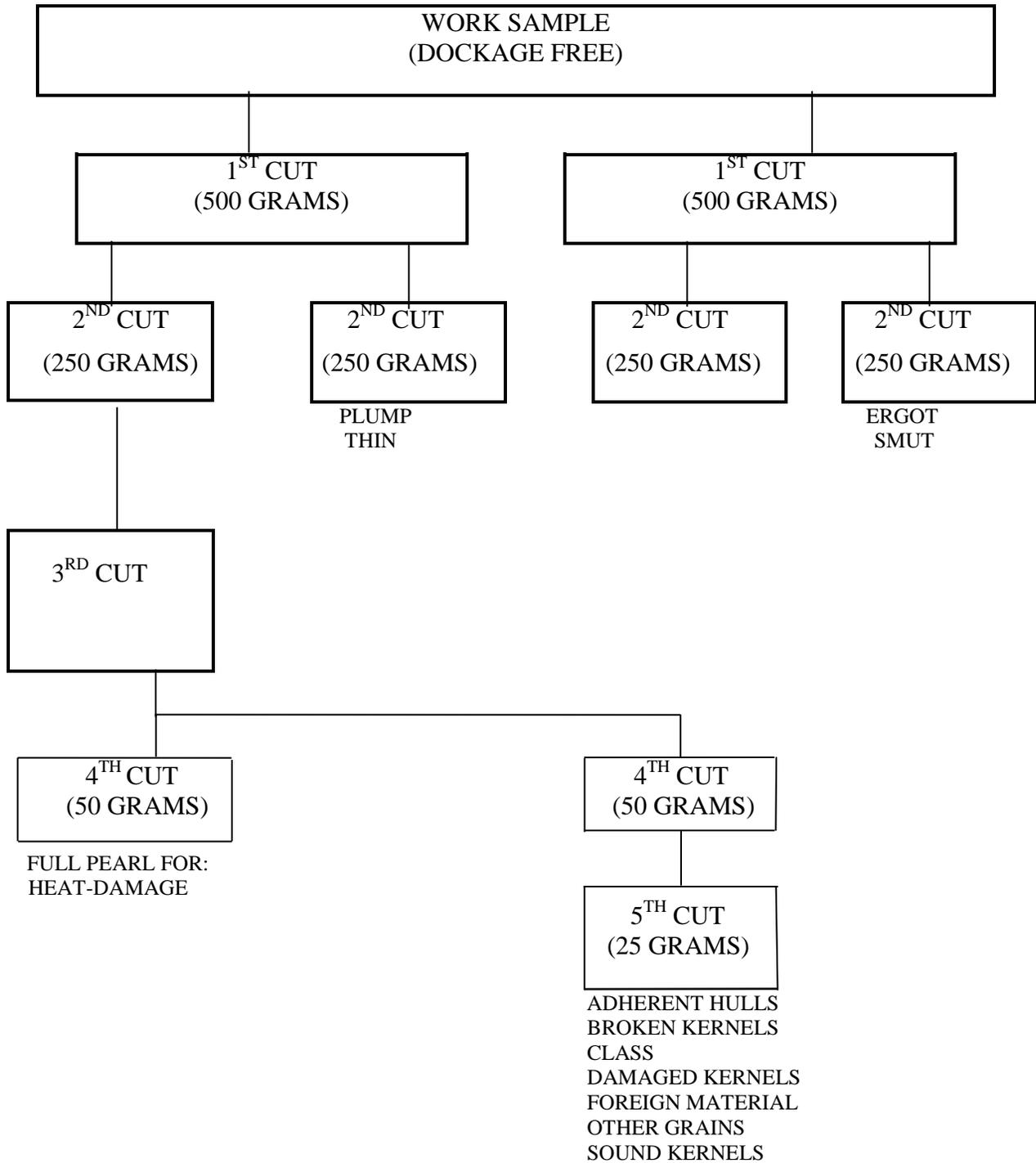
At this point, determinations have been made for moisture, garlic and other tests required to be performed prior to the removal of dockage. The percentage of dockage has been determined, and the sample has been test weighed and examined for stones and other special grade factors. Now divide the work sample into fractional portions for those determinations that are made on a dockage-free sample. Table No. 10 and Chart No. 1 illustrate how the sample is divided into fractional parts using the Boerner divider.

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Table No. 9 – Approximate Analytical Portion Sizes

FACTORS	GRAMS
Adherent Hulls	25
Broken Kernels	25
Class	25
Conventional Barley	25
Damaged Kernels	25
Ergot	1000
Foreign Material	25
Garlic Bulblets	1000 <u>1/</u>
Heat-Damaged Kernels	50
Kind of Grain	25 <u>1/</u>
Light Smutty	250 / 1000
Smutty	250
Other Grains	25
Thin Barley	250
Plump Barley	250
Sound Barley	25
Hulless Barley	25
<u>1/</u> Determined before the removal of dockage.	

Chart No. 1 – Dividing the Work Sample



NOTE: Sample weights on this chart are approximate.

6.18 – PLUMP HULLESS BARLEY

Hulless barley that remains on top of a 5-1/2 x 3/4 slotted-hole sieve after sieving.

Basis of Determination: Determine plump hulless barley on a dockage-free portion of approximately 250 grams.

Methods of Determination:

A. Mechanical Sieving Method

1. Mount the sieve and bottom pan on the mechanical sieve shaker.
2. Set the stroke counter for 30 strokes.
3. Return the material lodged in the perforations to the barley which remained on top of the sieve.
4. All material remaining on top of the sieve is “plump” hulless barley.

B. Hand Sieving Method:

1. Mount the sieve on a bottom pan.
2. Place the 250-gram portion in the center of the sieve.
3. Hold the sieve level in both hands with elbows close to the sides and the sieve perforations parallel to the direction of movement.
4. In a steady motion, move the sieve from left to right approximately 10 inches and then from right to left.
5. Repeat this operation 30 times.
6. Return the material lodged in the perforations to the barley which remained on top of the sieve.
7. All material remaining on top of the sieve is “plump” hulless barley.

Certification: Record the actual percentage of plump hulless barley on the pan ticket and the certificate to the nearest whole percent.

6.19 – THIN HULLESS BARLEY

Hulless barley which passes through 5/64 x 3/4 slotted-hole sieve after sieving.

Basis of Determination: Determine thin hulless barley on a dockage-free portion of approximately 250 grams. Use either the mechanical sieving method or the hand sieving method to determine thin. Return all material lodged in the perforations of the sieve to the hulless barley remaining on top of the sieve. The procedures for using either of these methods are described in section 1.18.

Certification: Record the percentage of thin hulless barley on the pan ticket and the certificate to the nearest tenth percent.

6.20 – ADHERENT HULLS

Adherent hulls are kernels and pieces of kernels of hulless barley which have 1/4 or more of the hull remaining on the kernel.

Basis of Determination: Determine hulless barley kernels with adherent hulls on a dockage-free portion of approximately 25 grams.

Certification: Record the percentage of hulless barley kernels with adherent hulls on the pan ticket and the certificate to the nearest tenth percent.

6.21 – NON-BARLEY MATERIAL

Basis of Determination: Non-barley material shall be the combination of dockage, other grains and foreign material. Determine dockage on the sample as a whole. Determine other grains and foreign material on a dockage free portion of approximately 25 grams. Non-barley material shall apply only to the classes Hulless Waxy and Hulless Barley.

Certification: Record the percentage of non-barley material on the pan ticket and the certificate to the nearest tenth percent.

6.22 – BROKEN KERNELS

Hulless barley with more than 1/4 of the kernels removed.

Basis of Determination: Determine broken kernels on a dockage-free portion of approximately 25 grams.

Certification: Record the percentage of broken kernels on the pan ticket and the certificate to the nearest tenth percent.

6.23 – HULLESS BARLEY VARIETY

Basis of Determination: Variety as stated by applicant. If the variety is not stated by the applicant, no variety will be recorded.

Certification: Record variety on the pan ticket and the certificate.

6.24 – CLASS DETERMINATION

Basis of Determination:

- A. Determine class, visually if possible, on a dockage-free portion of approximately 25 grams. If visual examination is not conclusive proceed to determination B.
- B. Determine class using a Waxy Endosperm Stain Test using the following formula, solution and procedure.
 1. Formula: Strong stock solution of 1.8 grams I₂ (Iodine-crystals-AW 126.91). 10.0 grams KI (Potassium Iodine-crystals-FY 166.01). 1000 ml H₂O
 2. Solution: Dissolve 10 grams of KI in 1000 ml of hot H₂O then add 1.8 grams I₂. This will give you a strong, stock solution. The stock solution should be kept in a dark brown bottle and kept out of the sunlight. This can be diluted as is needed for use with H₂O to obtain desired differential staining. Start with a 5:1 H₂O stock solution and increase H₂O as needed to obtain desired consistency. Once the stock solution has been diluted the diluted solution will lose its staining ability over a few days.
 3. Procedure: To check for waxy vs. non-waxy, pearl 100 grams of barley down to the endosperm layer (1/3 pearl), dip the sample in the diluted solution for 15-30 seconds and separate the dark blue stained (non-waxy) kernels from the reddish-brown stained (waxy) kernels.

Certification: Record the class on the pan ticket and the certificate.

6.25 – SOUND HULLESS BARLEY

Sound hulless barley is kernels, pieces of hulless barley kernels that are not damaged.

Basis of Determination: Determine sound hulless barley on a dockage-free portion of approximately 25 grams.

Sound hulless barley includes:

- A. Broken kernels of hulless barley which are not damaged,
- B. Green immature kernels of hulless barley not otherwise damaged.

Sound hulless barley does not include damaged kernels of hulless barley and material other than hulless barley.

The sum of the percentages of damaged kernels, foreign material, wild oats, conventional barley and other grains subtracted from 100 percent equals the percentage of sound hulless barley.

Certification: Record the percentage of sound hulless barley on the pan ticket and the certificate to the nearest tenth percent.

6.26 – HEAT DAMAGED KERNELS

Heat damaged is kernels, pieces of hulless barley kernels that are materially discolored and damaged by heat. (Reference: Visual Reference W-6.1 for heat-damaged (other than Durum))

Basis of Determination: It is necessary, in most cases, to cut the kernels and make a cross-section analysis to determine if the color is reddish-brown, mahogany, or creamy.

Certification: Record the percentage of heat-damaged kernels on the pan ticket and the certificate to the nearest tenth percent.

6.27 – DAMAGED KERNELS (TOTAL)

Damaged kernels (total) are kernels, pieces of hulless barley kernels, other grains, and wild oats that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-damaged, heat-damaged insect-bored, mold-damaged, stain-damaged, sprout-damaged, or otherwise materially damaged.

Special Insect Damage Analysis: The MT Standards for Hulless Barley consider Hulless Barley containing 5 or more insect-damaged kernels per 100 grams as MT Sample Grade.

Basis of Determination:

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- A. Damaged kernels. Determine damaged kernels on a dockage-free portion of approximately 25 grams.
- B. Insect-Damaged kernels. Determine insect-damaged kernels on a dockage-free portion of 100 grams. Insect-damaged kernels are kernels bored or tunneled by insect.
Reference: Interpretative Line-Slide No. B-6.0).

The factor damaged kernels is a grading factor in hulless barley. Damaged kernels are not considered as sound in any class of hulless barley.

In general, kernels of hulless barley, other grains, or wild oats are considered damaged for inspection and grading purposes only when the damage is distinctly apparent and of such character as to be recognized as damaged for commercial purposes.

TYPES OF HULLESS BARLEY DAMAGE:

- A. Blight-Damaged Kernels: Kernels and pieces of hulless barley kernels which are covered by at least one-third or more of blight. Blight discolorations should not be confused with badly stained, weathered, or water-stained kernels or kernels which have black discoloration on the tip of the germ end due to weather conditions.
(Reference: Interpretive Line Slide No.B-1.0).
- B. Frost-Damaged Kernels: Kernels and pieces of hulless barley kernels that are badly shrunken and/or distinctly discolored black, brown, or green by frost.
(Reference: Interpretive Line Slide No. B-3.1).
- C. Mold-Damaged Kernels: Kernels and pieces of hulless barley kernels that are weathered and contain considerable evidence of mold. Mold-damaged kernels are characterized by black or grayish spots or blotches on one or both sides of the kernel.
(Reference: Interpretive Line Slide No. B-1.1).
- D. Germ-Damaged Kernels (Sick and/or Mold): kernels and pieces of hulless barley in which the germ is discolored by heat or mold as a result of respiration.
(Reference: Interpretive Line Slide No. B-4.0).
- E. Heat-Damaged Kernels: Kernels and pieces of hulless barley kernels which are damaged by heat. The determination for heat-damaged kernels is made on a pearled portion.
(Reference: Interpretive Line Slide no. B-5.1).
- F. Weevil or Insect-Bored: Kernels and pieces of hulless barley kernels which have been bored or tunneled by insects.
(Reference: Interpretive Line Slide No. B-6.0).

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- G. Stained Kernels: Kernels and pieces of hulless barley kernels which are stained or weathered. Staining is characterized by black or dark discoloration of the one or both sides of the kernel.
- H. Sprout-Damaged Kernels: Kernels and pieces of hulless barley kernels which have sprouted, or which have swelling over the germ and after examination show sprout. (Reference: Interpretive Line Slide No. B-8.0).

Certification:

- A. Damaged Kernels: Record the percent and kind of damaged kernels on the pan ticket and the certificate to the nearest tenth percent.
- B. Insect-Damaged Kernels: When the hulless barley exceeds the 5 insect-damaged kernels per 100 gram tolerance, grade the hulless barley as MT Sample Grade and record the number of insect-damaged kernels on the pan ticket and certificate. Include in the remarks section of the certificate “Sample Grade” due to Insect-Damaged Kernels” and the amount of insect-damaged kernels per 100 grams.

6.28 – FOREIGN MATERIAL

All matter other than hulless barley and other grains that remains in the sample after the removal of dockage.

Basis of Determination: Determine foreign material on a dockage-free portion of approximately 25 grams.

Certification: Record the percent of foreign material on the pan ticket and the certificate to the nearest tenth percent.

6.29 – WILD OATS

Seeds of Avena fatua L. and A. sterilis L.

Basis of Determination: Determine wild oats on a dockage-free portion of approximately 25 grams.

Wild Oats Characteristics: Wild oats are usually identified by their slender kernels and twisted awns—so called “sucker mouths”—and basal hairs or bristles on the germ end of the kernel. (Reference: Interpretive Line Slide No. OF-Wild Oats).

Wild oats are not considered foreign material.

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Certification: Record the percent of wild oats on the pan ticket and the certificate to the nearest tenth percent.

6.30 – OTHER GRAINS

Corn, cultivated buckwheat, flaxseed, nongrain sorghum, oats, polish wheat, popcorn, poulard wheat, rice, rye, safflower, sorghum, soybeans, spelt, sunflower seed, sweet corn, triticale, Khorasan, and wheat.

Oat groats and hulless oats are also considered as other grains.

Basis of Determination: Determine other grains on a dockage-free portion of approximately 25 grams.

Other grains are not considered as sound in all classes of hulless barley.

Certification: Record the percentage of other grains on the pan ticket and the certificate to the nearest tenth percent.

6.31 – OFFICIAL CRITERIA

Vomitoxin is an “Official Criteria Factor” that is determined upon request. The level of mycotoxin does not affect the grade. The test kit “R-BIOPHARM, RIDASCREEN FAST, DON TEST METHOD” or any system of method that gives equivalent results shall be used for hulless barley vomitoxin determination. This methodology is described in FGIS Program Notice PN – 10 – 06 dated 12/28/09.

Results are certified under Montana Standards in the results section of the certificate.

6.32 – ASSIGNMENT OF GRADE

After each determination, record the appropriate results on the pan ticket. After completing the analysis, compare these results with the limits for each grade factor for the appropriate class of hulless barley as specified in the grade tables shown in section 1.1. Following the guidelines in section 1.2 enter the grade in the appropriate space on the pan ticket.

